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CS320

Digital Thermopile Pyranometer

Thermopile Accuracy, Digital Simplicity, Affordable Price

For measurement of global solar radiation under changing weather conditions

Overview

The CS320 is a digital thermopile pyranometer that measures broad-spectrum short-wave radiation and communicates over the simple SDI-12 protocol to the data logger. This sensor design eliminates measurement error and programming errors that can adversely affect data quality.

This pyranometer has been designed to improve the global solar radiation measurement significantly (even under cloudy conditions) without adding substantial cost. The CS320 is suitable for applications ranging from environmental research to agriculture to large mesoscale weather networks (mesonets).

The CS320 is manufactured using a high-grade anodized aluminum body and IP68-rated 316 stainless-steel M8 connector (marine grade). The CS320 sensor is heated (on/off switchable under user control) and allows continuous operation in changing environmental conditions. The pyranometer's calibration data is stored on the sensor.

Benefits and Features

- Thermopile sensor eliminates spectral errors associated with silicon-cell pyranometers
- Much lower price point than other thermopile sensors
- On-board sensor automatically detects if the CS320 is level for installation, diagnostics, and remote troubleshooting
- Designed for long-term stability and deployment
- Dome-shape sensor head allows dew and rain runoff
- Internal heater to reduce errors from dew, frost, rain, and snow
- SDI-12 digital output
- Detachable waterproof connector from sensor head for fast, easy servicing
- Calibration data stored on sensor

Detailed Description

The CS320 combines a blackbody thermopile detector with an acrylic diffuser. This design is a significant improvement when compared with the spectral response of silicon photocell pyranometers, while offering a comparable price. Thermopile pyranometers use a series of thermoelectric junctions (multiple junctions of two dissimilar metals following the thermocouple principle) to provide a signal of several μV/W/m^2 proportional to the temperature difference between a black absorbing

surface and a reference. The thermopile pyranometer's black surface uniformly absorbs solar radiation across the solar spectrum.

The 0.2 W heater keeps water (liquid and frozen) off the sensor to minimize errors caused by dew, frost, rain, and snow blocking the radiation path. Dew and rain runoff is faciliated by the dome-shaped sensor head (diffuser and body). This keeps the sensor clean and minimizes errors caused by dust blocking the radiation path. The sensor is housed in a rugged anodize aluminum body, and the electronics are fully potted.

The CS320 pyranometer has sensor-specific calibration coefficients determined during the custom calibration process. Coefficients are programmed into the microcontrollers at the factory. The CS320 has an SDI-12 output (SDI-12 version 1.4), where short-wave radiation (W/m^2) is returned in digital format. Measurement of the CS320 pyranometer requires a measurement device with SDI-12 functionality that includes the M or C command.

Specifications

Sensor	Thermopile detector, acrylic diffuser, heater, and signal processing circuitry mounted in an aluminum housing
Measurement Description	Measures broad-spectrum short-wave radiation
ISO Classification	Class C (second class)
Calibration Uncertainty	± 2.6%
Measurement Range	0 to 2000 W/m^2 (net short-wave irradiance)
Measurement Repeatability	< 1%
Long-Term Drift	< 2% (per year)
Non-Linearity	< 1%
Sensitivity	0.057 $mV/W/m^2$
Detector Type	Blackbody thermopile
SDI-12 Response Time	2 s
Field of View (FOV)	180°
Spectral Range	385 to 2105 nm (50% points)
Directional (Cosine) Response	< ±20 W/m^2 (at 80° solar zenith)
Temperature Response	< 5% (from -15° to +45°C)
Output	SDI-12 (version 1.4) 1200 bps
Zero Offset A	8 W/m^2
Zero Offset B	< 5 W/m^2
Operating Temperature Range	-50° to +60°C
Operating Environment	0 to 100% relative humidity
Heater	0.2 W (on-board)
Heater Power Requirements	25 mA current drain (at 12 Vdc)
Input Voltage Requirements	6 to 24 Vdc
Current Drain	❱ 3 mA (standby) ❱ 5 mA (measurement)
Uncertainty in Daily Total	< 5%
Error Due to Clouds	±2 %
Mechanical Rating	IP66/68
Factory Calibrations	Traceable to secondary standard blackbody thermopile pyranometers traceable to the world radiation reference in Davos, Switzerland.
Compliance with Standards	❱ 2011/65/EU RoHS Directive ❱ 2015/863/EU RoHS Phthalates Amendment
Warranty	4 years against defects in materials and workmanship
Diameter	3.43 cm (1.35 in.)
Height	3.96 cm (1.56 in.)
Weight	~65 g (2.3oz) May vary due to potting.

For comprehensive details, visit: www.campbellsci.com/cs320

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